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UV ABSORPTION PROCESSES IN THE DEBYE SPHERE, BY INTERACTION PLASMA – METAL ON THE SURFACE OF PLANT TISSUE EUGENIA UNIFLORA

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ABSTRACT

Using an electro dynamics quantum model of near field, the aim of this work is to prove the existence of radiation in the UV band, caused by the interaction of electromagnetic field distribution not neutral, high frequency plasma with metal nano particles (MNPs) deposited on the biological tissue surface samples (plant samples Eugenia Uniflora) by absorption processes - breathability.

KEYWORDS: Electromagnetic Fields, Electrical Conductivity, Hamilton Operator, Electric Permittivity & Voltage

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Original Article

INTRODUCTION

If the plant tissue is taken as a electromagnetic field net sensor and in turn a natural catalyst, any abnormal change generated by the sample environment may be detected and quantified using signals in the same modification range.

If the environment of the plant tissue vicinity suspend metal particles and depending on their size, they could absorb and subsequently remitted to the tissue surface as waste, but not returned to the environment, causing loss functional tissue which is essential for photosynthesis process.

In the present work is developing the mathematical model of the quantum behavior of the electromagnetic fields ***E*** and ***B,*** in the Debye sphere range for a non-neutral plasma frequency (2–10). 10^{16} Hz, by a transformation in reciprocal space. This approach should lead to the fine structure calculation of the spectral lines of the UV ray emission in area range, or what is the same, in the Debye length range of the plasma.

THEORETICAL MODEL

For the problem of electromagnetic nearby field, the Hamiltonian for the interaction, between the configuration of high plasma frequency and a nano particle (NP), it appears like [1]:

$$\hat{H}_j = \frac{1}{2m}\left(\hat{p}_j - \frac{e}{c}\hat{A}_j\right)^2 + eEx_j - \mu B \tag{1}$$

Where: e –electrical charge representing the electron; $\hat{p}_j$ – j the impulse operator; μ- magnetic moment of the NP; B – magnetic field generated by the plasma; $\frac{e}{c}\hat{A}_j$ - j – the operator defines the magnetic pulse system.

Developing the calculation for the Hamilton operator of the equation (1) in the model of Feynman path integral, an approximate expression is obtained for the matrix element:

$$\langle x_{j+1}|p_j A_j|x_j\rangle = e^{-\frac{i}{\hbar}\tau U^*}\frac{A_j}{h}\int p_j dp_j e^{-\frac{i}{\hbar}p_j^2\frac{\tau}{2m}+\frac{i}{\hbar}\frac{e}{mc}p_j A_j\tau} \tag{2}$$

Where the function:

$$U^* = \frac{1}{2m}\left(\frac{e}{c}A_j\right)^2 + eEx_j - \mu B \tag{3}$$

In the proposed model of reciprocal space, to solve the equation (2), the function that describes the radiation in the Debye sphere is:

$$f(k) = \sum_{j=1}^{n}\left(\frac{a_{j+1}j(j+1)+\alpha a_{j-1}}{\beta}\right)k_j \tag{4}$$

Where: $\alpha = \frac{2m\mu B}{\hbar^2}$; $\beta = \frac{2meE}{\hbar^2}$;

k_j – Representation in reciprocal space factor reverse position.

The function described in equation (4) becomes zero if the condition is met:

$$\alpha = -\frac{a_{j+1}j(j+1)}{a_{j-1}} \tag{5}$$

Representing the magnetic moment of the system: $\mu = -\frac{\hbar^2}{2mB}\frac{a_{j+1}j(j+1)}{a_{j-1}}$

The latter mathematical expression leads to the calculation of the radiation length, in the Debye area as:

$$a_o = \frac{C_j}{\lambda_{UV}} \tag{6}$$

Where: C_j – constant conversion of reciprocal space, which is determined from the boundary conditions.

EXPERIMENTAL PROCEDURE

(Used Technique)

EugeniasUniflora leaves were used, in order to determine the MNPs existence probability of surface, depending of UV radiation from plasma phase not neutral. The experiments were performed taking into account pattern samples of blue Gold and Magnetite characterization, which leads to quantify the contamination degree from air, through this kind of particulate material.

The plasma chamber used in this work has Nd magnet system, which can control and focused the plasma phase in a region of approximately 3 cm radius, around the connected electrodes to a variable AC source.

For the experimental development of this work, a plasma chamber was designed conditioning system Nd magnets, such as to allow the plasma focus in a region of approximately 3 cm radius, around the electrodes connected to the variable AC source.

The measuring electronic device has a configuration such that, the voltage into the plasma frequency, the vacuum pressure, the internal temperature in the chamber and recording system records simultaneously, the UV radiation.

The preparation plant tissue process of the samples was carried out, with the assistance of an expert biologist on the subject of chemical detection of particles, on the plant surface tissue. Once characterized, the sample surface were taken those which have existence of certain metal nano particles and exposed them to the direct action of non-neutral, high plasma frequency (2 – 10). 10^{16} Hz generated in the chamber and subsequently, in the electronic sensing system, were recorded and analyzed the data obtained from samples of current, voltage and UV radiation. The sampling time was held in a range of (1-5 min), then the action of vacuum pump causes the samples, that have a high dehydration in the process, leading to the loss on the surface of the sample's nano particles.

RESULTS AND ANALYSIS

The plasma cero concept is used in this work, to identify the electromagnetic characterization from generated plasma produced inside the chamber without leaves tissue, or in other words, cero point. This characterization was performed, in order to have a standard frequency pattern of UV radiation, the voltage behavior coming from the plasma phase, as a function of the time and the magnetic field distribution, depending of such configuration. Above mentioned behaviors are displayed in figure 1.

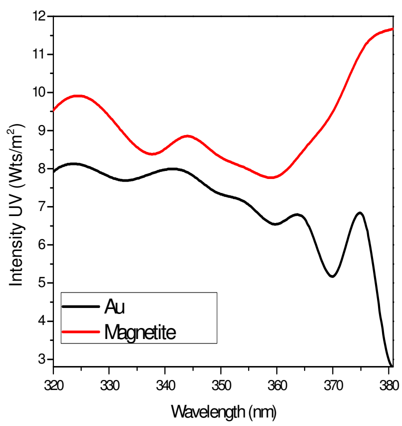

Figure 1: Absorption Behavior from Blue Gold and Magnetite Samples (UV Wavelengths)

Measurement Electronic Device (MED)

On the other hand, was designed and built at Measurement, Electronic Device MED, to sense the above mentioned variables with the aim to sampling and determine the behavior of samples at different times.

The fist sampling variables were carried out having a decreasing instability UV radiation generation of magnetic field at 0, 25 s. At this time all vegetable issue inside the chamber did not show UV-C absorption pattern, just because the leaves are transparent in these wavelength regions and its energy transformation process to photosynthesis process is given at 230 to 380 nm; in this case O_2 molecule acts as a transport catalyzer of radiated energy. After 0.25 s, the UV absorption pattern is evident, see Figure 2.

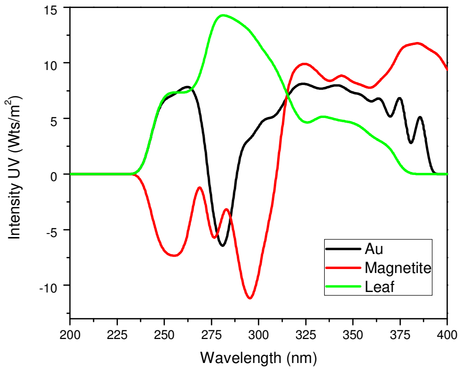

Figure 2: Absorption Comparison Behavior from Pattern Samples of Blue Gold and Magnetite (UV Wavelengths Using Eugenia Uniflora Leaf)

Comparing the UV absorption obtained results on vegetables issue samples (EugeniasUniflora), were used two kinds of references, a thin film of Blue Gold and Magnetite as the second one obtained by the Spry Pyrolysis coating process.

The references UV absorption behaviors in the wavelength range of 300 to 380 nm are displayed in figure 1. And in the figure 3 are displayed the same, but in the range of 930 to 950 nm.

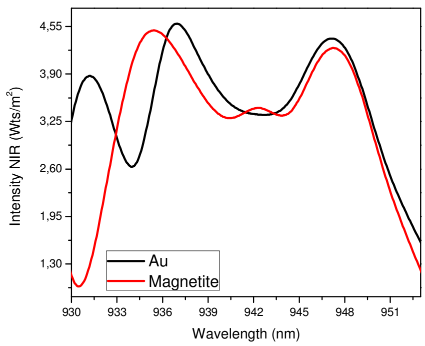

Figure 3: Absorption Behavior from Blue Gold and Magnetite Samples (NIR Wavelengths)

In the planning and development of the mathematical model it was found that, for any distribution of charge carriers of the hyperbolic type, the calculation of the radiation function and hence determining the electrical conductivity, leading to the establishment of a variable coefficient differential equation known as Riccati equation, which hinted that, the distribution of the local role in the hyperbolic structure has the same configuration.

On the other hand, if a distribution of the exponential type carriers is assumed, the solution was simpler and led to a distribution of the electrical conductivity of the reverse type diffusion length Ln, Lp. This was applied to distances in the simulation process in nm, namely, to see the interaction of the nanoparticles and the surface of samples as plasmon. The current and voltage measured data in the samples, showed behaviors, according to a distribution of hyperbolic type, which corresponds to the simulation process proposed in this work. The simulation process of equations (2) and (4) were conducted with the use of the Matlab 7.1 calculation program.

UV Simulated Plasma Model

In Figure 2 the simulated model of the charge-carrier density, in the Debye sphere is represented within 300 (μm), whereas in Figure 3, the non-linear trend of the frequency distribution of said carrier in the same area shown.

At the same time, it were performed comparative analyses between pattern samples and vegetable tissue samples, in the range of 930 to 951nm, as shown in Figure.4, indicating the absorption behavior in the NIR region. The data confirm the higher density of the Eugenia Uniflora leaf, compared with other kind of common vegetable leaf, the higher CO_2 retention causing the absorption at 885 to 900 nm weaker, related to the absorption at 901 to 917 nm.

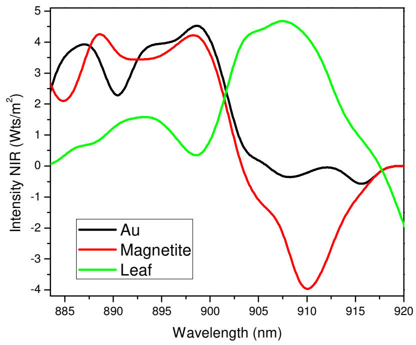

Figure 4: Absorption Behavior from Blue Gold and Magnetite Samples (NIR Wavelengths with Eugenia Uniflora Leaf)

The simulated model and the quantum function, which is describing the frequency Debye sphere; it is clear that, the region of UV emission due to interaction with the surface potential of biological samples in the plasma chamber. This form of frequency distribution of carriers, in the plasma generated in parts of the nanoparticles adhered to the sample, an avalanche of charge carriers, depending on the gradient of the electric potential in the sample, while in other areas, it generates a damming thereof, produced by sensitive to variations in structure, and which together create locally a thermal gradient electric field.

RESULTS AND DISCUSSIONS

Considering the hypothesis in the framework of UV radiation, in the sphere of Debye for a non-neutral plasma, in the presence of biological tissue samples, with inlay metallic nanoparticles, the anisotropic behavior of this radiation was evident, due to the multiple effects of collision between particles, the particle tunneling effect on the metal surface of nanoparticles and variation in temperature. The above results have supported, each with a pair of calibration and experimental results, which were chosen taking into account, the initial conditions of the problem and that met the dynamic equations of the performance of domestic power to the system.

CONCLUSIONS

- The anisotropic behavior of UV radiation in the Debye sphere of the non-neutral plasma, results from the superposition of state's radiation emitting UV atoms and thus the collapse of the wave functions describing the entire process. Furthermore, to measure UV signal into the plasma, it gave thanks, "so to speak," quantum de coherence observable in the measurement.

- This leads to improve the measurement system and to develop a series of multiple experimental tests, mainly to determine with greater certainty the measurement of UV radiation into the system of non-neutral plasma.
- The theoretical application of the mathematical model proposed in this report and partial experimental results, specifically express the influence of the relative humidity of the samples and pore density in the behavior of the electrical conductivity in the biological tissue model in other reports has not been found so far.

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